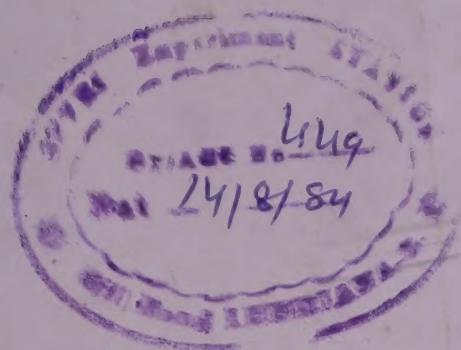


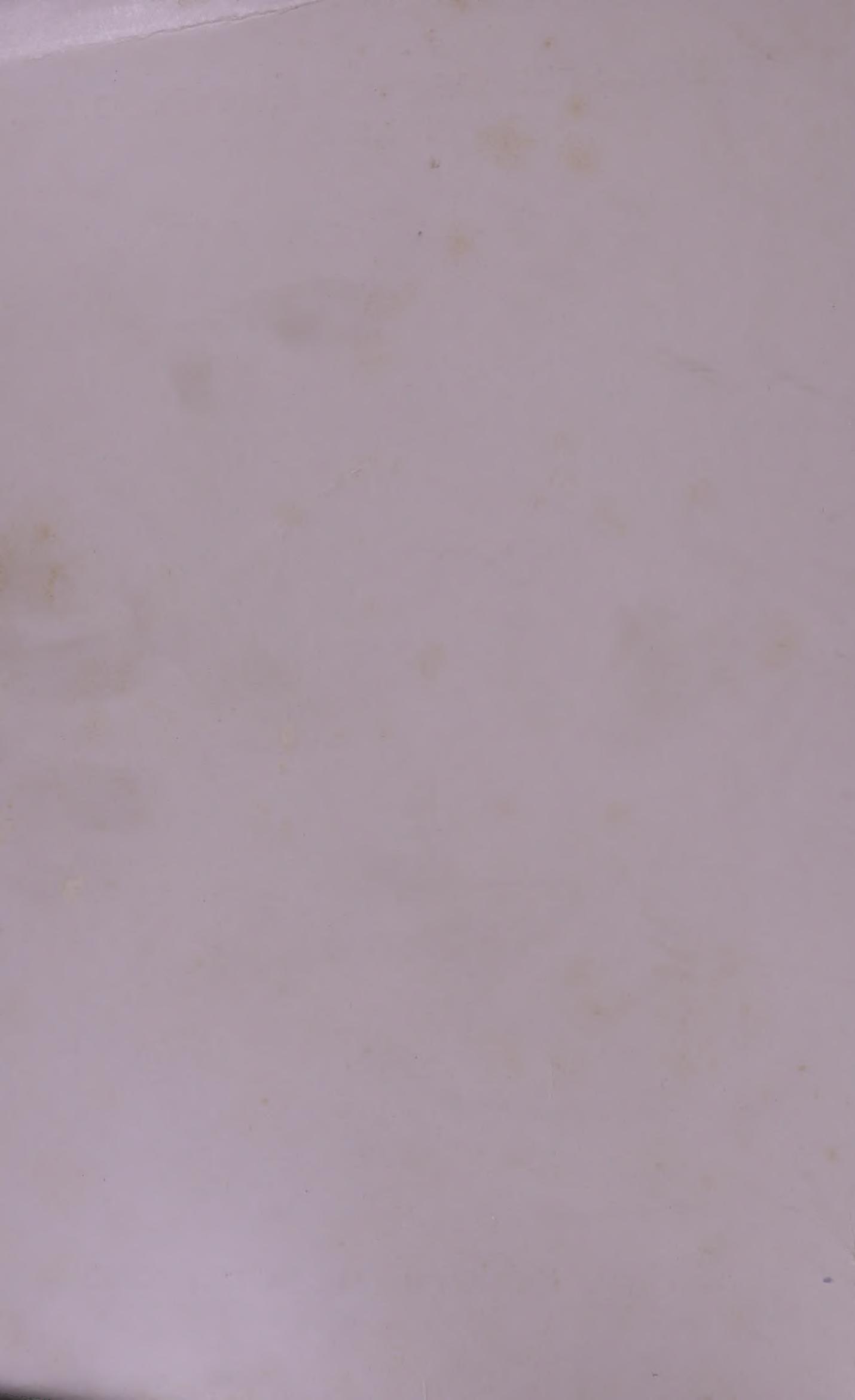
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**CELERY SEED AND CELERY SEED OIL
IN INDIA**



BY
S. K. ARORA



47
**REGIONAL RESEARCH LABORATORY (CSIR)
JAMMU-KASHMIR**



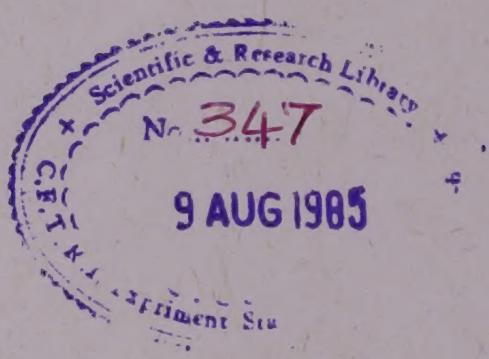
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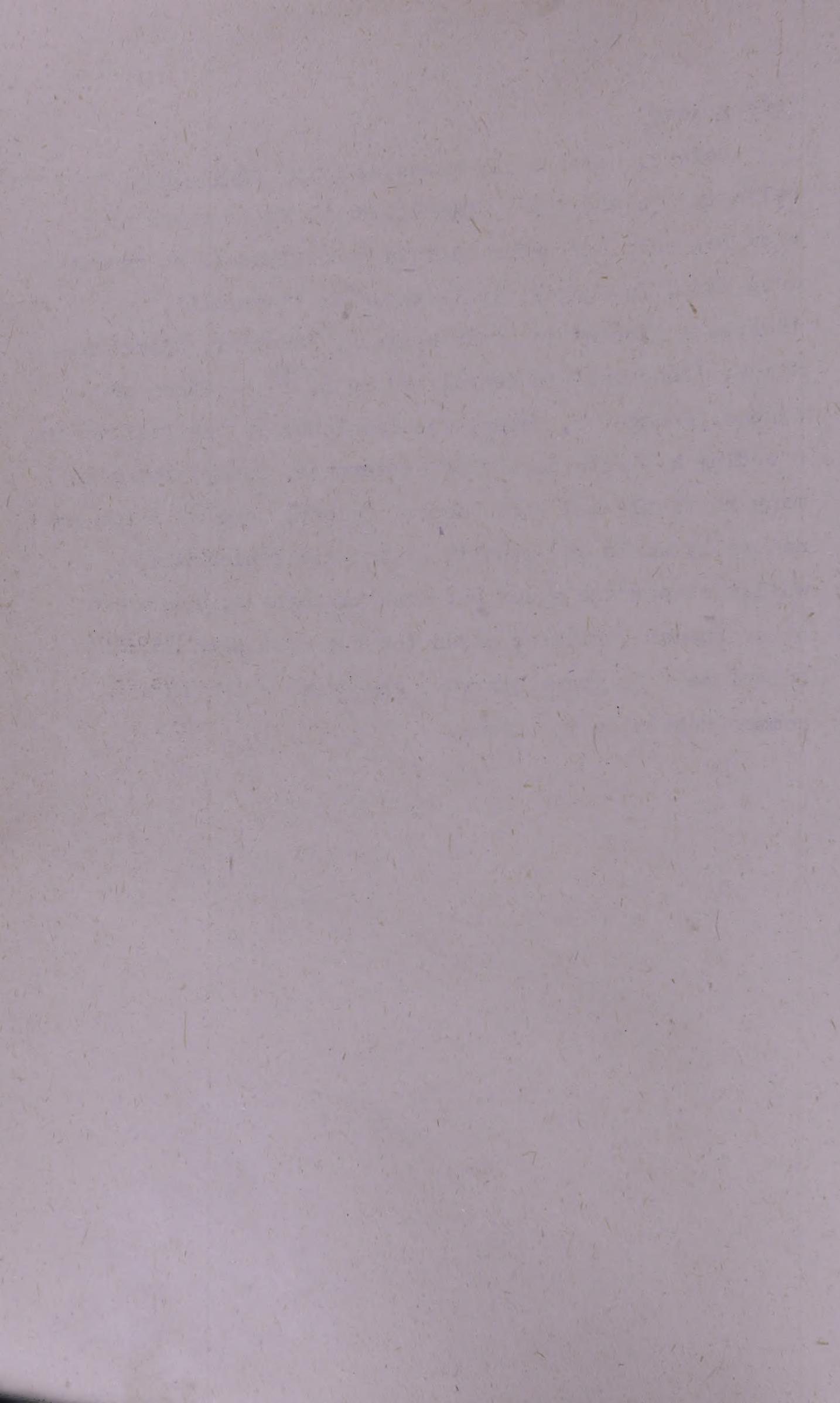
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Celery seed

Celery, botanically known as Apium graveolens, is a herb belonging to the family Umbelliferae. It is grown as a biennial crop and under certain conditions as an annual crop also. In Punjab, it is known as 'Karnauli', 'Khersani Ajowan' in Uttar Pradesh. 'Shalari, Ajmud' in Hindi, 'Rendhuni' in Bengal and in S. India ^{outh} Ajmod or Ajmoda. Presently, Celery was developed by the Italiana in breeding a strain devoid of bitterness. Today, there are many horticultural varieties of Celery, some of which are naturally white and usually called 'self bleaching' whilst others are green but lack bitterness. There are other summer varieties grown for the root such as Celeriac (A. graveolens var. rapaceum) which is a common vegetable in Europe.

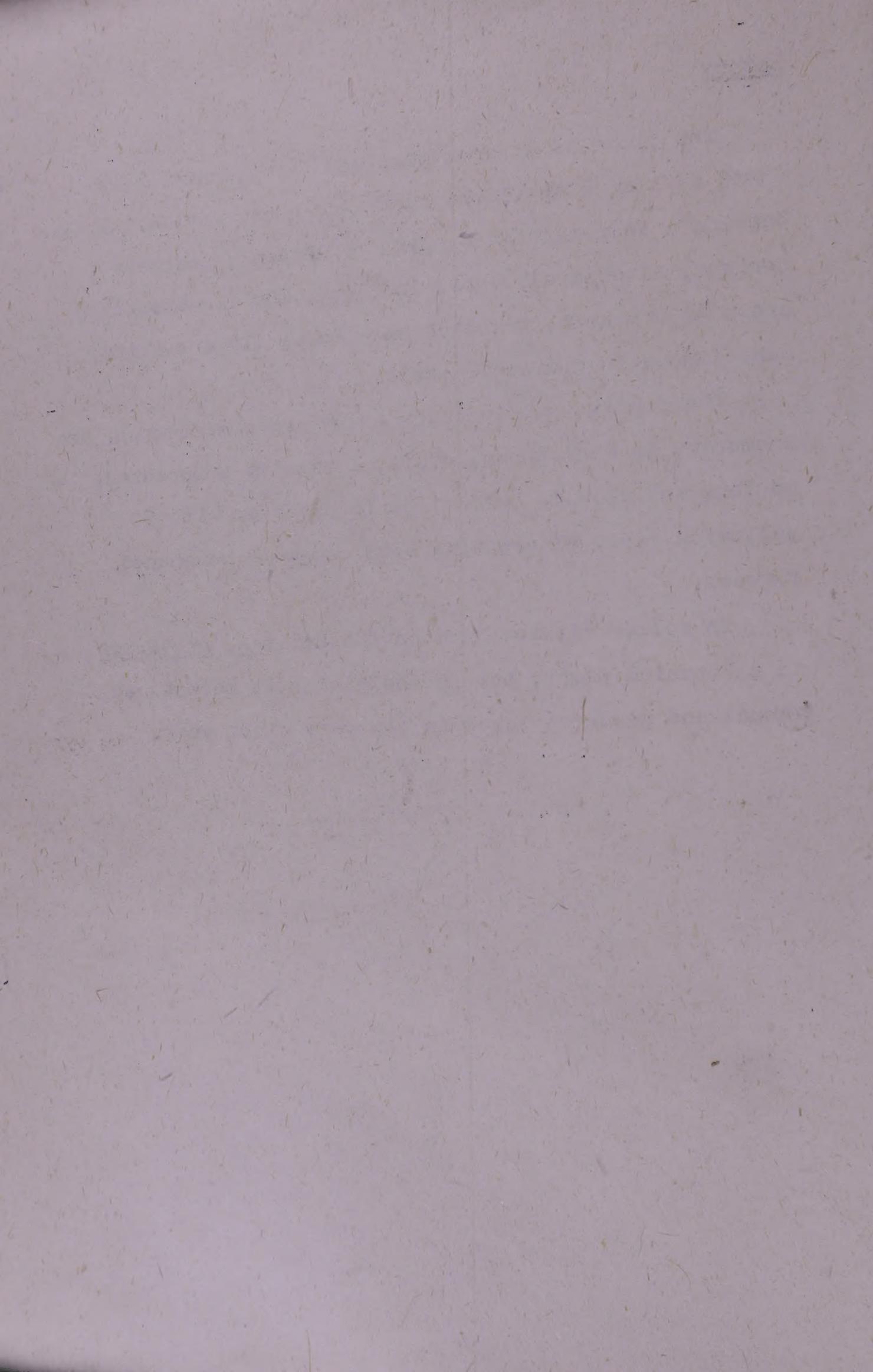


Botany

The plant is an aromatic, usually biennial herb 15-38 cm long with fleshy roots and succulent leaf-stalks bearing a terminal and 3 pairs of lateral, coarsely serrate, alternately lobed leaflets. The flower-stalks are 60-90 cm high, branched and leafy; flowers white, conspicuous in compound umbels.

The fruits usually occur as separate mericarps. The crenocarp is dark brown, ovoid, laterally compressed, 1-2 mm long and usually below 1 mm in diameter with 5 yellowish ribs, alternating with somewhat roughened furrows.

In colder climates and on the hills A. graveolens is a biennial plant, but in the plains it becomes an annual and produces seeds in the very first year.



Cultivation

In India, Celery is mainly grown in Amritsar, which has roughly 3/4th of the total cultivation. In Punjab, it is also cultivated in Batali, Jallandhar, Ludhiana, Sialkot, Kapurthala, in Uttar Pradesh at Saharanpur and in Haryana at Karnal, Pahwa, Shanti and Kandhola. It is cultivated for the seed in winter season. The crop is grown as a transplanted crop in all the above-mentioned places. 45-60 days old seedlings from nursery are transplanted in the last week of January. A few farmers grow it as a direct seeded crop on small scale in Amritsar. The direct seeded cropping system occupies fields for a relatively longer period of time. Date of harvest for both the systems being mid May, the direct seeded crop gives substantially higher yield. Both the systems are maintained at 20 cms.apart.

The oil content of seed obtained by both the methods does not vary, indicating thereby that this trait was not influenced by planting methods. However, in direct seeding process, it has been observed that the yield of Celery seed/acre goes up which in a way offset the higher production costs.

It is also cultivated in France and U.S.A. Previously, it was cultivated in China Belt; however, Chinese Celery is not suitable for distilling the Celery seed oil, it is used for grinding in spice formulations. Three fourth of the total

world cultivation of Celery is in India. There are roughly 1500 Celery seed cultivators in India. Maximum number is in Amritsar District. List of villages in Amritsar where Celery is cultivated is given in Annexure-I.

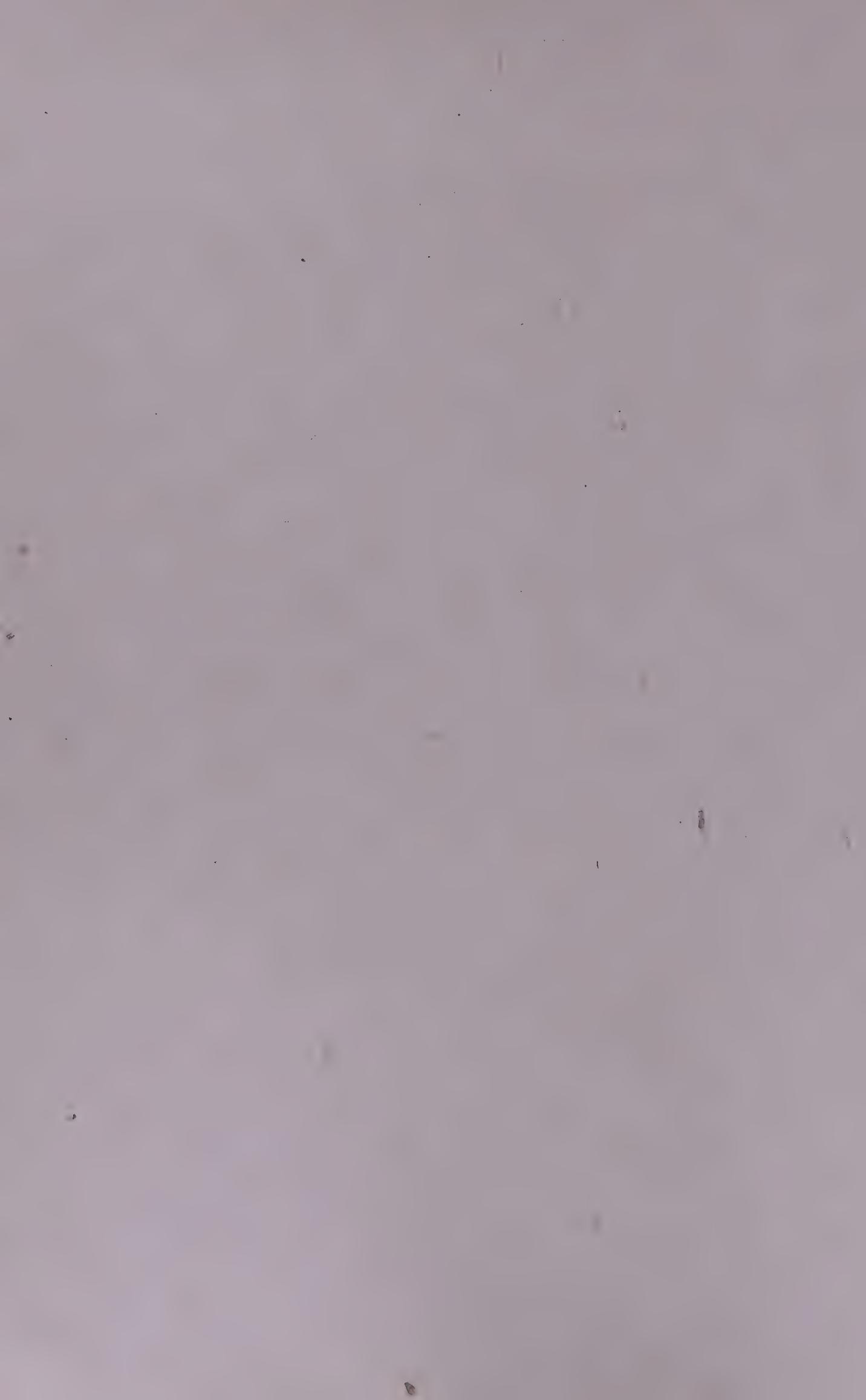
Harvesting

The crop matures in 180-200 days. The crop should be harvested in the 2nd and third week of May when the fruits are mature enough and turn ash brown in colour showing signs of partial drying.

The average production of Celery seed in India being 3200 tonnes/year. Approximate total production in different parts of the country is given in Table-II.

Processing and cleaning

The Celery seed when harvested contains over 20% dust, but the limits of dust in India and foreign markets being 1-3% so the dust is removed in the processing plants. There are a few processors in India who have the capacity to clean 10 tonnes of seeds per day. Please see addresses of the processors in Annexure-II



Marketing

Celery seed is marketed in processed form mainly during the months of May to July and also continues sometimes till December. The seed was sold at the rate of Rs.500-600 per quintal in 1982. 1976 was an exceptional year because of great demand and rates were higher than normal. Only a part of total produce of Celery in India is consumed within the country. Substantial quantity is exported to USA and demand in America is supplemented by imports from China and Hungary. Although the demand for Celery seed is increasing but the demand for the herb is not expected to increase in near future. It is expected that its demand may even decline.

Celery is very popular flavouring agent in Netherland but most of its demand is satisfied by domestic production which is supplemented by imports in small amounts from India, France and China. Its annual consumption is 75-100 tonnes, nearly all of which is used by the food processing sector.

In several respects the United Kingdom market for Celery is similar to that of Netherland. The vegetable and leaf being mainly satisfied by local supplies, whereas Celery seed for condiment purposes is imported. The United Kingdom market for Celery seed is around 200 tonnes per annum with India being the major supplier. Consumption of Celery is very small. Switzerland's consumption of

Celery is very small. The Belgium market for Celery seed is estimated at about 20 tonnes per annum which is imported mainly from India for use in both the industrial and retail sectors. Dehydrated celery is also used in small quantities.

In Japan Celery is mainly employed in curries and celery salt, whilst smaller quantities of dehydrated Celery are also used as a condiment. Consumption is estimated around 150-200 tonnes annually. Most of Celery is imported from India. Celery being used in France as a vegetable is cultivated on a limited small scale. Bulk of requirement of France is met from Indian supplies and to small extent supplemented by imports from Egypt, China and local production. The annual consumption of Celery seed in France is 200-300 tonnes.

The Federal Republic of Germany (West) is totally dependent on imports for supplies of Celery seed where the annual consumption being averaged 66 tonnes in 1970, some of which was re-exported and supplies are supplemented by those from China and Hungary. Although the demand for Celery seed is increasing, but the demand of the herb is not expected to increase.

Prospects

The fact that an indigenous demand for Celery seed and flavour is satisfied by local production. The consumption of Celery seed is stable, increase if any is very small. Future prospects of Celery seed are hard to define. Because of the hard competition with China in the international market, the rise in price of Celery seed has not been commensurated with rise in costs of agricultural inputs. Thus, leaving for growers very little operative margin vis-a-vis other cash crops, so the area under cultivation of Celery has been shrinking. In Saharanpur, cultivation of Celery is negligible now. However, overall areas has been the same since some new areas have been brought under cultivation.



Chemical composition of Celery seed³

The chemical composition of the Celery plant is given in Table-III and II-B. Traces of copper and arsenic are also reported in the tuberous root (moisture 84%) whose food value appears to be very low and the herb is reported to contain the glucoside, apin. The Celery fruits yield 2-3% of pale yellow volatile oil with a persistant odour characteristic of the plant. The volatile oil from the green leaves (0.1%) is of no commercial importance.

Chemical composition of Celery leaves and stalks

<u>Chemical composition</u>	<u>Leaves</u>	<u>stalks</u>
Moisture	81.3	93.5
Carbohydrates	8.6	3.5
Fat	0.6	0.1
Protein	6.0	0.8
Calcium	0.23	0.23
Phosphorus	3.14	0.04
Iron	6.3 mg/ 100 gm	4.8 mg/ 100 gm
Vitamin-A	5800-7500 I.U.	Nil
Vitamin-C	62 mg/ 100 gm	6 mg/ 100 gm

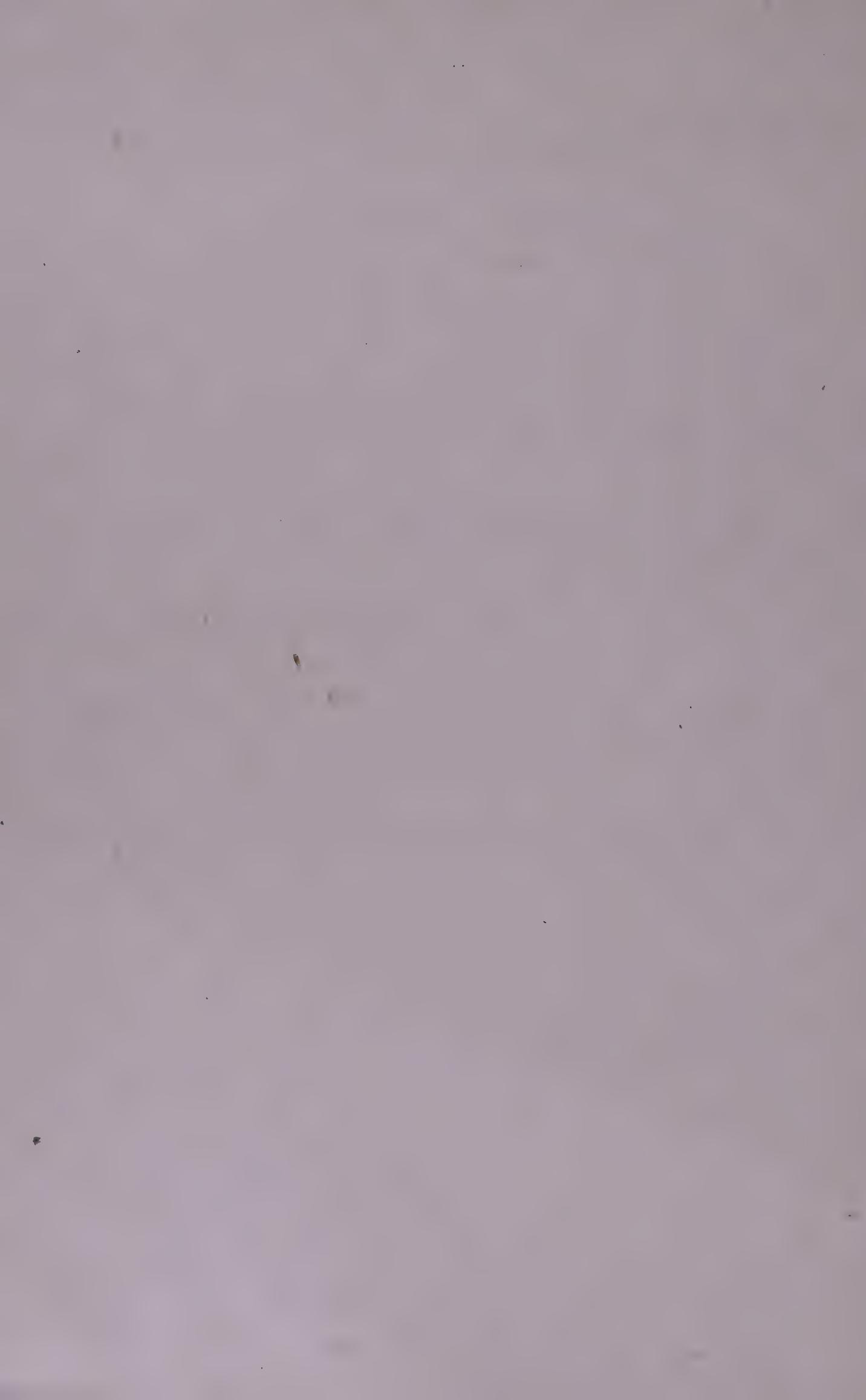
Part-II: Celery seed oil

The principal use of Celery seed oil is in the flavouring of all kinds of food products as meats, sauces, canned soups and particularly in the flavouring of the popular Celery salts, Celery tonics and culinary sauce. Celery seed oil is one of the most valuable flavouring agents imparting warm aromatic and pleasing note to food products.

Most of Celery seed imported by USA is used for distillation of oil.

Volatile oil is not only present in the seeds but all parts of the herb. Green parts of the herb yield about 0.1% oil. It is reported that about 3-5 tonnes of Celery herb oil are distilled, but there are doubts as regards to commercial usage.

Roots also yield some oil with a characteristic odour. Root oil and herb oil do not form the trade products.



Physico-chemical properties of Celery seed oil

Specific gravity at 15° 0.866 to 0.898
mostly above 0.872

Optical rotation +51°0' to
+ 82°0'

Refractive index at 20° 1.487 to 1.480

Acid number upto 4.0

Ester number 16.0 to 55.0

Ester number after acetylation 43.0 to 67.0

Solubility: Soluble in 6 to 8 vol. of 90% alcohol mostly
with turbidity. Soluble in 1 to 1.5 vol. of 95%
alcohol. Sometimes opalescent with more.

Constituents

The following constituents have been reported in Celery seed oil:-

Limonene:

The oil contains about 60% p-limonine. Other terpenes are apparently not present and the oil is free from Pinene. Since fractional distillation yields no fraction below boiling 170°.

Selinene

According to Semmler and Risse, Selinene occurs in Celery seed oil which consists of a mixture of alpha- and beta isomers with 10 to 15% selinene. Besides limonene and selinene which amounts to 70% of the oil of celery seed also contains some oxygenated compounds.

Sesquiterpene alcohols

The Schimmel Chemists noticed the presence of 2.5 to 3% of the alcohols in Celery seed oil.

Sedanolide

The highest boiling fractions of Celery seed oil contains 2.5 to 3.0% of this lactone.

Sedanonic anhydride

The higher boiling fraction also contains 0.5% of Sedanonic anhydride which is tetrahydro-n-butyridine-phthalide.

There are significant difference in the oil yield from seeds harvested at different stages of maturity. The



seeds harvested in the first stage contain oil content about 1.10%. The oil content steadily increases from first to fourth stage of harvesting. There is progressive improvement in the second harvest (1.48%) and in the third harvest (1.78%). The seeds crop grown in Panjab is harvested when the seeds are immature and green. This is because the green seeds are reported to fetch higher market price. The second and third stage of harvesting coincides with the immature green or partially mature and ash brown umbel. In the last stage of harvest i.e. at complete maturity, the oil content goes upto 2.3%. At this stage the seeds are fully matured with brown ash colour and majority of umbel becomes dry. Celery seeds should be harvested between 180 to 200 days after initial sowing.

Distillation of Celery seed oil

Volatile oil from fruits can easily be steam distilled. Usually fruits are crushed just before charging into still. Powdered material is spread evenly and packed in the still. Channeling in the packing results in low yields. It is prevented by taking suitable precautions. The crushed material is not stored as the oil is lost due to evaporation. Steam distillation of Celery is rather slow and it takes 10-12 hours for one batch.

-: 15 :-

LIST OF VILLAGES GROWING CELERY IN AMRITSAR DISTRICT

Chota Haripura	Cherchakar
Bhariwal	Nyampur
Chalkhud	Rajpur
Tupai	Mandiala
Taran Taran	Thanda
Candwal Sahib	Galwali
Wada Nag	
Chhota Nag	
Majitha	
Jandiala	
Manawala	
Aeharbanpur	
Talwandi	
Kotla	
Bahadur GARH	
Fatehgarh Churian	
Roria	
Churia	
Pratap Pur	
Thandi	
Cheta	
Kotli	
Sultan Wind	
Chati Wind	
Iban	
Bharu	
Chebal	
Banjwah	
Mandiala	
Balia	
Chwhan	
Khalia	
Gurudas	
Nawarkot	
Wadli	
Dogra	
Halikpur	
Deodarpur	
Risalpur	
Kalan	
Aahan	
Brahun	
Mera Chak	
Fatehpur	
Balkalan	
Kaiboh	
Kharabad	
Besark	
Kotla Saida	

Annexure-II

Processors

1. M/S Krishan Chand Brij Kumar, Majith Mandi, Amritsar
2. M/S Grover & Sons, Majith Mandi, Amritsar
3. M/S Swani Corp., Katra Hari Singh, Amritsar
4. M/S Suran Singh Ram Singh, Katra Hari Singh, Amritsar
5. M/S Saran Singh Lachman Singh, Katra Hari Singh, Amritsar.

Annexure-III

Names of distillers of Celery seed oil

Farukhabad

1. M/S Ram Narain Pratap Narain, Perfumers, Kannauj
2. M/S Ishwar Prasad Chandhi Prasad, Kannauj
3. M/S Munna Lal Sons & Co., Perfumers, Kannauj
4. M/S Mohammad Ayub Mohammad Yakub, Perfumers, Kannauj

Kanpur

1. M/S Unite Perfumery Co., 66/18, Busatoli
2. M/S Standard Essential Oil Distillers, 84/113, Juhi Railway Under Bridge, Carwalganagar-1.
3. M/S Ram Krishan Gupta & Bros., Perfumers, 33/7, Gaya Prasad Lane

Delhi

1. M/S Gupta Perfumery Pvt. Ltd., Sadar Bazar,
2. M/S Kanta Chemicals, Tilak Bazar
3. M/S Synthetic Chemicals, Trivandrum

Buyers of Celery seed

Annexure-IV

1. M/S A.A. Sayin & Co. Inc., P.O. Box No. 1.Y. Street, Hoboken, N.J. 67030.
2. M/S L.A. Chanpan & Co., 70, Hodson Hoboken, J.J. 07030
3. M/S Louis P. Inc. 170, Stewort Avenue Brooklyn, N.York, 11237
4. M/S Quality Control Spice Co. Ind. 1910, Roth St., P.O. Box 528.
5. M/S Quality Spice Co. 1000, South 2nd St. Harrison, N.J. 07029
6. M/S Mowrmis Co. Ind. 11350 N. McCormick Road
7. M/S Hunt Valley Maryland 21031
8. M/S Mincing Trading Corp., 10m Willon St. M. Onachic, N.J. 07074
9. M/S Gel Spice Corp. Inc., 593, Medonald Avenue, Brooklyn, New York.
10. M/S Adrien SA B.P.89, 13277, Mor Beille Codex 2, France
11. M/S Bush Boake Allen, Blackhorse Lane, London, E175, QP England
12. M/S John Vellys Ltd., Precost St., London EI-8, 88, England.
13. M/S P. Robert andcie Grasse Am., France
14. M/S Fritache Dodge and Cscott Inc. 76, Nikm Venue, N.Y. 19911, USA.
15. M/S J. Mankame Inc., 47-22, Pearson Place, Longis Land City, I.Y., N.Y. 11101, USA.

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CARRIER SHED EXPORTS & IMPORTS

Quantity: Tonnes
Value: Lakhs

	1976-77	1977-78	1978-79	1979-80	1980-81
Quantity	2735	2738	3283	3153.4	3197.8
Value	154.6	218.6	203.6	192.6	156.3

Table - II

Area under cultivation & production of Celery seed
in India 1981-82

Places (Districts)	Area(Ha.)	Produce(tonnes)
Amritsar	2200	2200
Ladwa	600	500
Shameli	100	100
Kandhola	100	100
Batala	20	20
Saharanpur	20	20
Jallandhar	5	4
Ludhiana	5	3
Pahwa	25	20
Kapurthala	25	20
Karnal	25	20

The above figures have been collected from the
Cultivators Association and Dealers of Celery seed.

Parties contacted

1. Dr. G. S. Randhawa and B. J. Sidhu, Agronomy Deptt. Panjab Agricultural University, Ludhiana
2. Govt. Ind. Deptt., Ludhiana
3. S. B. Lal, M/S Gupta Perfumers, Sadar Bazar, Delhi
4. Sh. Jugal Kishore, M/S Kanta Chemicals, Tilak Bazar, Delhi
5. M/S Japan Bottle House, Tilak Bazar, Delhi
6. M/S Gogia Chemicals, Tilak Bazar, Delhi
7. M/S Seth Brothers, Tilak Bazar, Delhi
8. M/S Radha Sales Corp. 304. M-3, AVG Bhavan, Cannaught Place, New Delhi.
9. M/S Govt. Industrial Deptt. Kashmiri Gate, Delhi
10. M/S Krishan Chand Brij Kumar, Majith Mandi, Amritsar
11. M/S Grover Sons, Majith Mandi, Amritsar
12. M/S Swaini & Co., Katra Hari Singh, Amritsar
13. M/S Suran Singh Ram Singh, Katra Hari Singh, Amritsar
14. M/S Saran Singh, Lachman Singh, Katra Hari Singh, Amritsar
15. Cultivators of village Mulachak, Amritsar
16. Shri Isher Singh
17. Shri Paul Singh
18. Sh. Painam Singh
19. Sh. Kartar Singh
20. Shri Tarlok Singh-Agent Celery seed Amritsar (Punjab)

Cultivators

Acknowledgement

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Kaul





